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THE VIRGINIA JOURNAL OF SCIENCE

VOL. 5, NEW SERIES JANUARY, 1954 NO. 1

Factors Influencing the Growth Of Research In Southern Universities

GEORGE F. GANT
Southern Regional Education Board

Southern universities face a knotty problem in the development of their graduate research programs. The agricultural and industrial revolution in the South is making heavy demands upon them for a larger number of professional and graduate programs. The vastly improved economic level of the South makes it possible for thousands more young people to go to college and to take advanced work. The consequent growth in graduate education is taking place during a period when funds for research – basic to graduate education – are controlled largely by federal and industrial agencies. This growth is also taking place at the same time as an expansion in undergraduate education, which produces severe competition for money and personnel. The problem inherent in this situation is how to develop programs of research and graduate education of quality when the necessary funds are so hard to get under conditions which preserve the universities' essential freedom and integrity.

Let me illustrate. I have been reading recently about the financing of research in colleges and universities. Two reports have been particularly illuminating: John D. Millett's staff report *Financing Higher Education in the United States* (published 1952 for the Commission on Financing Higher Education by the Columbia Press) and The National Science Foundation's study *Federal Funds for Science: I. Federal Funds for Scientific Research and Development at Nonprofit Institutions* (published 1953 by the U. S. Government Printing Office).

Perhaps the following quotations from these reports, which confirm each other, will startle you as they did me.

> "Out of 132 million dollars of [federal] contract research, probably 100 million represented services purchased from universities which only indirectly and to a limited degree added to the educational program of the institutions involved." (Millett, p. 417).
>
> "Based on the data available from this study, it appears that about half of the funds now going to educational institutions

Editor's Note: We are pleased to present this invited article by Mr. George F. Gant, Consultant on Graduate Programs, Southern Regional Education Board.

> contribute little to the primary objectives of these institutions." (National Science Foundation, p. 3).
>
> "Perhaps the most salient characteristic is the existence of a continuing collaboration between the Government and the contracting organization, as a result of which the Government determines the general objectives and work plans of the center and supplies the funds to operate it, while the contractor provides principally managerial services." (National Science Foundation, p. 9).
>
> "There is scarcely a first-rate physics or chemistry department providing graduate instruction in our universities which could maintain its present standing or personnel without federal income." (Millett, p. 355).

The situation implied in these statements is that the quality and extent of research in universities are determined in large measure outside the universities themselves. Yet research, although by no means a monopoly of universities, is an integral and necessary function which is central to their whole purpose and to their integrity. The ability and freedom of higher institutions and their faculties to seek new truth according to their own decision and within their own competence are basic to the very idea of a university. Moreover, it is of crucial importance to all of us as individual citizens in a democracy, and to the Nation, that the traditional self-determination of higher institutions concerning their research and academic programs be preserved. I believe colleges and universities do have additional responsibilities to devote their resources to the solution of local and national problems. This service function, however, is not only subordinate to, but derives its merit from, the excellence of the research and teaching functions. It should be added, also, that the colleges and universities cannot solve their problem of program determination by ignoring or severing connections with outside sources of support for research. On the contrary, if they are to have strong programs, they are almost obliged to come to terms with conditions and trends as they exist.

Pattern of Research and Development.[1]—Universities are the junior partners in the Nation's research and development program. The money volume of research and development in 1952 was 3.5 billion dollars — 2.3 billion was expended by industry, .8 billion by the federal government, and .4 billion by nonprofit institutions including colleges and universities. Of about 160,000 research engineers and scientists engaged in research and development projects, 60 per cent were employed by industry, 20 per cent by government, and 20 per cent by universities. Not only are universities the smallest member of the team, they are dependent upon government and industry for most of the funds they are able to get for research. Millett estimated that in 1950 federal contract research performed by colleges and universities was about 60 per cent of their total

[1] Figures in this section are taken from the NSF report referred to above.

expenditures for organized research activities. If we add other federal funds for agricultural and medical research, we find that the government provided about 70 per cent of all the income used to support this part of the work of higher education. This relationship creates major problems for the universities.

The NSF report presents a very clear picture of the volume and character of federal research for the fiscal year 1951-52. In that year federal funds for scientific activities of all kinds totalled 2.2 billion dollars. Of this amount, 295 million dollars were for scientific research and development at colleges and universities. This 295 million dollars went to colleges and universities in three ways: (1) 144 million dollars for twenty-one research centers for which the government sets the objectives and work plans and the universities provide chiefly managerial services; (2) 93 million dollars for purchased research and developmental projects to assist federal agencies to carry out specific responsibilities; and (3) 58 million dollars for sponsored research to support efforts to add to the general fund of scientific knowledge as a matter of public interest.

In view of the amount and proportion of university and college research financed by the federal government, the characteristics of that research are significant.

1. Only 12 per cent, 225, of the 1871 institutions of higher learning received research funds. However, one third of the 687 institutions with a present or potential capacity for research received funds.

2. Five institutions received 55 per cent of the funds; 50 institutions received 91 per cent, with the remaining 9 per cent being distributed among 175 institutions. Of the institutions receiving funds, 17 per cent are in the South. They received 6 per cent of the funds. Six institutions in Virginia received $1,138,000 in 1951-52.

3. Two-thirds of the total funds were expended in four states — Massachusetts, New York, Illinois, and California.

4. Eighteen federal agencies administer these research funds, although two — the Department of Defense and the Atomic Energy Commission — administer 88.5 per cent of the total.

5. For the most part, each of these several federal agencies selects the institutions to which grants are made on the basis of criteria and procedures it devises for itself.

6. Work in the physical sciences received greatest emphasis — 72 per cent of the total funds — as against 19 per cent for the life sciences, 3 per cent for the social sciences, and 6 per cent for increase of research and development plant.

7. "Directed" research in research centers and "purchased" research was almost 80 per cent — leaving 20 per cent for "supported" or "sponsored" research.

Federal expenditures for research in institutions are, of course, only one of the ways in which federal research and educational activities affect colleges and universities. Millett estimates that in 1950 the proportion of income received from the federal government by all institutions of higher education — large and small, public and private — was 28 per cent of their total income. For universities it was 32 per cent. Payments for veterans' educational benefits were 58 per cent of the $468,305,675 received by institutions in 1950, and payments for contract research were 28 per cent. Other payments were for experiment stations and agricultural extension and for training programs for federal personnel. These several activities are relevant here because the very magnitude of federal support for higher education is influential in the planning of college and education programs, including their research programs. More particularly, decisions made by federal agencies about what programs should be provided for federal employees, and in what institutions, have a direct bearing on the decisions of the colleges and universities on the specialized programs they will offer.

Finally, with respect to federal activities in research which have an impact on institutions of higher education, it will be recalled that total federal expenditures for research and development in 1951-52 were 2.2 billion dollars. Over 90 per cent of these funds were used to support research and development programs in non-educational agencies — in programs conducted directly by the federal government, in programs supported by the federal government in industrial agencies, and in private and nonprofit institutions. This means, of course, that as far as quantity of research is concerned, the amount done by institutions is dwarfed by that done by the federal government itself — either directly or through other agencies. We are all familiar with the many government research laboratories scattered around the country. A development of the past decade is the construction and operation of major research and development centers — chiefly under contract — in the new and expensive fields such as atomic energy and aeronautics. The extent to which university personnel benefit in their own research and instructional programs from these large centers depends upon their willingness, and success, in making satisfactory arrangements with federal agencies and their contractors. To put it another way, the centers of research leadership and activity, in many fields, have been removed from the universities.

The figures for the extent of research and development activity by industry are not so readily available as are those for the federal government. We do know, however, that in several fields industries maintain their own individuals or joint research laboratories. In oil, for example, and in many of the chemical fields such as plastics and fibers, the major laboratories are industrial and the research and development leadership in these specialized fields is with industry.

Although to a lesser extent than in the case of the federal government, industry also makes gifts and grants to educational institutions. Millett estimates that such funds and other private benefactions, including founda-

tion grants, comprise 6 per cent of the income of universities and colleges. In addition, many grants and gifts go directly to students and faculty members. The availability of these funds, the desires of the donors, and the interest of colleges and universities in getting such funds, all have an impact on institutional research policy and program in much the same way as is true in the case of federal funds.

The general pattern of research and development as it affects universities might be summarized in the following way:

1. An overwhelming part of the scientific research and development being done in the United States today is being conducted by federal and industrial agencies.

2. An overwhelming portion of the scientific research being conducted by universities is financed by federal and industrial agencies.

3. An overwhelming portion of the scientific research financed in universities by government and industry is "directed" or "project" research in the physical and biological sciences.

4. An overwhelming portion of the scientific research financed in universities by outside agencies is conducted by a very small proportion of the universities which have present or potential research capacity.

5. For the most part, federal and industrial payments to institutions are made by many diverse and uncoordinated agencies under policies and procedures (such as selection of institutions) which are obscure.

Impact of Research Pattern on Universities. — Almost every faculty member interested in research has experienced or can anticipate the influence of this national pattern of research and development upon his institution's own research policy and program. A phenomenon in university administration in recent years has been the tendency of many of the larger institutions to organize their research programs more formally — for so-called "organized research". There are several reasons for this trend, but one of the major of them is undoubtedly the problem of negotiating and administering contracts with federal and industrial agencies. One of the chief functions of the institutional research office is ordinarily to solicit funds. This development in university organization obviously has many advantages in that it helps secure support for research of interest to university faculty, handles troublesome legal, administrative, and fiscal matters, and encourages inter-disciplinary cooperation. It should be noted, however, that this organization trend threatens a departure from the traditional manner of treating instruction and research as integral parts of the same essential process of education. In some cases separatism has resulted from the nature of research contracts entered into and the research

organizations established to administer them. In these cases research projects become almost completely disassociated from the central university program, and funds and contracts are solicited, or at least accepted, for their own sake rather than because they support the university program as such.

The peculiar way in which university research is financed makes it difficult for a university to maintain a desirable balance between basic and applied research, on the one hand, and between the physical and life sciences and the social sciences and humanities on the other. As seen, most of the funds available are for applied projects in the physical and biological sciences. It is true that some universities have used "overhead" income from contracts to support the social sciences and the humanities. It is also true that for the most part research in the social sciences and humanities is comparatively inexpensive. Nevertheless, the influence of outside interests and funds create the problem of balance in a university's research and academic program.

Not only the balance of program is involved, but the kinds of research which can be financed are restricted. A large part of it, as seen, is "project" research of an immediate problem-solving type for which are prescribed all kinds of special conditions ranging from frequent progress reports to secrecy. In some instances the faculty member engaged on a research contract may feel that he is more closely supervised by and obligated to the outside agency than to his own institution. Even more threatening, obviously, is the pressure upon faculty to become more interested in research for which funds are available than in research which is more in keeping with their professional instincts and university program.

Not the least of the impacts upon universities of this general situation concerning research is that of competition — competition with other institutions for money and competition with government agencies and industry for personnel. Neither federal agencies nor industries have a coordinated or general policy concerning the widespread distribution of funds for research or even of advertising and eligibility to compete for such funds. This statement is not made to suggest that such policies should be instituted, but to emphasize the peculiar circumstances with which a university must deal in getting support for its research. It operates largely in the dark, flashing its light from time to time on likely sources of funds and keeping in touch, literally, with as many influential people as possible. In many cases, to hold its staff, the university *must* have research contracts, not only to have a research and graduate program of merit in a given field, but to be able to pay its faculty competitive salaries. Further, with respect to personnel, the educational institution must compete not only with other colleges and universities, but with government and industrial agencies as well. Never able to pay salaries as high as those in these agencies, the university must try to stay within at least the range of such salaries and to press its advantages in prestige and working conditions. Because of the serious shortage of scientific personnel, however, the mere hope that universities can compete is illusory. It is becoming

increasingly necessary for universities to work out systematic relations with industry and government so that the limited supply of competent persons can be most productive in the interest of all.

Other problems concerning factors influencing university research could be identified, not the least of which is uncertainty about the continuation of any particular research project and even about the stability of research support in general. Enough has been presented, however, to sketch and illustrate the situation as it has emerged during the past decade or so. It would be unrealistic for universities either to ignore these problems or to attempt to avoid them by refusing outside grants or contracts — they simply would not be able to maintain their research standing. What alternatives are there? That brings us to the situation in the South, which is particularly acute because of the painfully rapid growth in college and university enrollment and program.

Rapid Growth of Higher Education in the South. — The changes taking place in higher education in the South are little short of being phenomenal. Whereas in 1940 there were only 355,000 students (exclusive of summer and special students) in southern colleges and universities, in 1950 there were 603,000 — an increase of 70 per cent. The sudden increases were due in part to the large veteran-student group immediately after World War II. After a couple of years of decreasing enrollments, the number of students is rising again. The figures for the past thirty years show that the South's enrollments, though still lower, are increasing more rapidly than those of the Nation as a whole.

The future will bring an even larger growth. The population experts estimate that the Nation's college age population will increase to 10,000,000 by 1960 — a rise of 16 per cent from 1950 — and to 14,000,000 by 1970, which is a jump of 60 per cent from 1950. The educational statisticians think that the number of college students will level off at about 25 per cent of the college age population — it was 21 per cent in 1950, 16 per cent for the South. In applying these trends to the South, I will assume that the region's proportion of the Nation's college-age persons will decline from its 33 per cent in 1950 to 32 per cent in 1960 and to 30 per cent in 1970. I feel safe in doing so because the change in the southern economy from agriculture to industry, with higher incomes, will bring the balance in population to more nearly that predominating in the Nation as a whole. In addition, for our purposes here, it is conservative to estimate a lower proportion of college-age youth. I will also assume that the number of the South's college students will increase from 16 per cent of the college-age group in 1950 to 21 per cent in 1960 and to 25 per cent in 1970. This assumption seems warranted because of the progression of the past thirty years, which shows the South about ten years behind the Nation in educational trends of this kind, but more particularly because of the economic advances already referred to, and because of the rapid equalization of educational opportunities for Negroes.

Based upon these two assumptions, the number of the South's college students will increase by 70,000 by 1960 — to 670,000 students — and by

450,000 above 1950 to a total of 1,050,000 students in 1970. This is an increase of three-fourths over 1950 enrollments and amounts to three times the 1940 enrollments; the increase alone is almost 100,000 more students than were in college in 1940.

As startling as these increases are, the growth in the number of graduate students in southern universities is much greater in proportion, and most significant for our purposes here. Whereas the total number of students increased by 70 per cent between 1940 and 1950 and will increase by 75 per cent between 1950 and 1970, the number of graduate students more than doubled between 1930 and 1940, and it tripled between 1940 and 1950 — from 10,500 to 34,000. In 1950 five and one-half per cent of the South's college students were taking graduate work. In the Nation as a whole, six and one-half per cent of the college students were taking graduate work ten years earlier, in 1940, and nine per cent in 1950. If the trends in the South continue, and if the South continues to duplicate the Nation's experience, the proportion of the South's students in graduate work will reach nine per cent in 1960 — 60,000 — almost twice the number of 1950. If the proportion were not to increase at all between 1960 and 1970, the number would increase to 90,000. I think it reasonable to assume that the proportion will increase to twelve per cent, or to 126,000 graduate students in southern universities in 1970. This is almost four times as many as there are now.

There are other evidences of rapid change in higher education in the South which have their bearing on graduate education and research. More and more graduate and professional courses are being offered to satisfy the needs of the southern states which are parties to this virtual agricultural and industrial revolution which is producing higher income levels to support demands for professional and technical education in a large number of diverse fields. A review of growth of colleges and universities in the South between 1946-47 and 1950-51 illustrates the changes which are taking place:

1. The value of buildings, grounds, and equipment per student compares favorably with the national average.
2. The number of volumes in libraries increased from 17.3 million to 23.7 million — 37 per cent. The total amount spent annually for books and periodicals increased from 2.7 million dollars to 4.3 million dollars — an increase of 61 per cent.
3. The number of faculty members with doctor's degrees increased by more than 50 per cent — from 32 per cent of the faculty in 1947 to 38 per cent in 1951.
4. The number of graduate students increased from 17,700 to 39,000 — an increase of 120 per cent.
5. Whereas the number of bachelor's and first professional degrees awarded increased 59 per cent, the number of mas-

ter's and second professional degrees awarded increased 143 per cent and the number of doctor's 90 per cent.

Perhaps somewhat similar comparisons for Virginia would be of interest. Whereas there were 23 accredited four-year colleges and universities in Virginia in 1947, there were 25 in 1951. The percentage of Ph.D.'s on the faculty increased from 31 to 36. While undergraduate enrollment declined by 19 per cent, graduate enrollment increased 144 per cent. The increase in bachelor's degrees awarded was 33 per cent, in master's degrees 106 per cent and in doctor's 56 per cent. The amount spent for books and periodicals increased by one-third.

The growth in the graduate and research programs of southern institutions is coming at the same time as an exceptionally rapid growth in undergraduate education, and during a period when competition for funds is keen. The exact costs of graduate education are not known, but it is known that they are substantially higher than those of undergraduate programs. The bill for higher education as a whole is overwhelming, and the total is of concern to us here. In 1950, $374,000,000 was expended by southern institutions of higher education for educational and general purposes. If expenditures increase by about the same proportion as the increase in the number of students — by three-fourths — the total bill in 1970 will be $654,500,000 — $280,500,000 more than for 1950 and about two and one-half times the expenditure in 1940. Higher education is expensive and graduate education is even more expensive. The figures I have given do not include any additional sums needed to improve the quality and to extend the scope of graduate education.

Universities Can Cooperate to Cope with Factors Influencing their Research Programs. — The preceding sections outline the pattern of research and development in this country and the problem which that pattern poses for the individual university, particularly the southern university. The problem, broadly stated, is how the university can retain its freedom, integrity, and leadership in research in face of a shortage of funds and under the weight of the research programs of federal and industrial agencies. I believe the universities must join hands to cope with factors which are too large and diffuse for the individual institutions to handle.

The intellectually free university is an essential part of the foundation of our society and culture. This freedom has attracted the confidence and reliance of the American people and has helped to stimulate heavy demands for service and a tremendous growth in enrollment. The individual university can no longer exert enough leadership or strength, by itself, to deal adequately with the forces in the environment which shape its program. The single institution is not able to influence sufficiently, or with enough assurance, the policies or practices or programs of government and industry. I think that the only way in which the leadership of each university can be expressed, and its freedom and integrity protected, is in the company of its sister institutions. It is only through inter-university cooperation that it can participate responsibly, accountably,

and effectively in the formulation, with government, industry, and professional organizations, of those policies, methods, and programs which are now dependent upon it and others for execution but in the formulation of which it has too little voice. Such cooperative arrangements will not suffice if they are for protective purposes, or for competitive purposes, or for general purposes. They must be arrangements for constructive and specific leadership in connection with particular issues and programs.

Neither is the single institution any longer in a position to inaugurate and conduct specialized programs of advanced research and instruction without regard for the programs already under way in its sister institutions in the region. The costs of such programs are too great and the competition for available funds is too keen to permit the development of such specialized programs which needlessly duplicate each other and which, by the dispersion of funds, lead to mediocrity in too many fields and to excellence in too few.

In the South, the Southern Regional Education Compact was organized by fourteen states to encourage universities to avoid unnecessary duplication by sharing the development of strength in costly specialized programs in professional and graduate fields, and through their cooperative arrangements, to be able to work more effectively and more influentially with federal and industrial agencies. The education compact, although it originated in the South, is not unique in the South. The far western states are also encouraging inter-university cooperation under an inter-state compact. The New England states and the western provinces of Canada are in the process of forming inter-institutional and inter-governmental arrangements for the same purposes.

The Southern Regional Education Compact is not regulatory; it exercises no authority over any educational institution or government agency. Rather, it functions by encouraging the universities to formulate regional agreements, under which those interested share in the conduct of specialized programs so that they more effectively supplement each other and more adequately serve the region as a whole; it systematizes the regional programs in agreements among the universities and the Board; it secures recognition and support of the programs in the several states; and it provides regional backing in coordinated relationships with government and industrial agencies.

Such regional programs are now in effect in ten fields — medicine, dentistry, veterinary medicine, social welfare, nursing, forestry, pulp and paper technology, marine sciences, city planning, and petroleum sciences. About two-thirds of the South's universities are parties to one or more of the agreements under which these programs are conducted. Organized studies are now under way to examine the feasibility of such programs in about twenty additional fields such as architecture, statistics, government, foreign affairs, public health, agriculture, and psychology.

Each regional program has three related objectives:

> 1. To get the best results out of the cooperation of those universities specializing in a given field. There are six schools of forestry in the regional program of forestry, for example, three in city planning, seven in petroleum sciences.
> 2. To develop courses and services to meet the needs of all the fourteen Compact states so as to make the establishment of additional specialized programs unnecessary unless special circumstances so require.
>
> 3. To develop collective relationships with the governmental, industrial, and professional agencies, with the backing of the region through the Southern Regional Education Board, under which the policies, procedures, and programs of these outside agencies can be more adequately planned and conducted, insofar as they involve university participation, with mutual regard for academic integrity as well as particularized research and educational results.

The Compact Program is young, only five years old, but it has already demonstrated promise as a method by which southern universities can collaborate in meeting their major problems of money and outside influences in developing their programs of research and graduate education. There are other forms of inter-university cooperation, also, which have shown their utility in helping the individual institution maintain its integrity in the face of a changing environment. As the southern universities grow in the scope and quality of their work, and in the extent of their social and economic leadership, it is imperative that they continue, expand, and strengthen their collaboration so that together they can give assurance that each of them is better able to preserve the freedom and integrity for which we depend upon them.

A Study of Dogs as Vectors of Salmonella In the Area of Richmond, Virginia

WILLIAM PAUL BENNETT
University of Richmond

Reports have recently appeared in the literature showing that animals of various types may serve as vectors in the transmission of *Salmonella* infections to man. Investigations made on the intestinal flora of birds, cattle, horses, swine, and rodents have demonstrated the fact that these animals are potential reservoirs of many *Salmonella* organisms capable of producing infections in man. Casperson (1937), Magnuson (1938), Kauffmann and Henningsen (1939) identified the dog as the probable source of infection to human beings having salmonellosis. Since these reports others have attempted to determine the percentage of the animals carrying Salmonella species and to determine the nature of bacterial organisms carried by dogs. Wolff (1947) reported an eighteen per cent infection in the first hundred dogs he examined. Craige (1948) reported the isolation of two *Salmonella* organisms from two-hundred rectal cultures of dogs. Then Kintner (1949) examined seventy-one dogs in the Ohio State University Clinic and found eighteen per cent of these dogs to be positive for salmonellosis, agreeing with the results of Wolff. In the same year Cruickshank and Smith (1949) examined five-hundred dogs from a kennel which cared for stray dogs, and established the rate of infection with *Salmonella* as one per cent.

The most extensive and recent work done in this field has been reported by Galton, McElrath, Stucker, and Hardy (1950) of Jacksonville, Florida. Their continuous research in the state of Florida deals with impounded, hospitalized, and kennel dogs, thus giving them a cross section of the stray, pet, and racing greyhound dogs in this State. Depending upon the locality from which the dogs were derived, they reported an infection rate varying from 2.6 per cent to 71.4 per cent in stray dogs; 0 per cent to 36.1 per cent in the hospitalized animals; and 6.2 per cent to 93.1 per cent in the racing dogs.

From the literature cited, it is evident that there is still a need for more comprehensive studies of dogs as potential carriers of *Salmonella* infections. In addition, no attempt has been made to survey the *Salmonella* organisms that might be found in the dogs of the Richmond, Virginia, area. For this reason the writer has undertaken a study of *Salmonella* species isolated from 500 normal dogs of the Richmond, Virginia, area, divided equally between stray and pet individuals. The writer hopes the findings herein reported will constitute a contribution to the knowledge of *Salmonella*-dog-man relationships.

MATERIALS AND METHODS

This study is based upon organisms isolated from the feces of 500 normal dogs, which showed no signs of diarrhea, vomiting, or temperature. Two hundred and fifty of these animals were impounded either in the Richmond City Pound or in the Medical College of Virginia research laboratories, which received its animals directly from the pound. These could be assumed stray animals which had enjoyed the free run of the streets. The other 250 animals were hospitalized in the Broad Street Veterinary Hospital. These animals were not ill, but had been admitted to the hospital for grooming, immunization, and other normal procedures. These dogs could be assumed to be well-cared-for pets. Only those dogs which had been hospitalized or impounded for less than five days were examined to lessen the possibility of the dogs becoming infected while impounded or hospitalized.

The feces were collected from the stray animals by means of sterile wooden applicators. These applicators were used as probes in collecting the feces from the rectum of the animal. The probe was then immersed in 10 cc. amounts of differential broth as described below. The specimens from the pet dogs were collected essentially in the same manner by the veterinarians of the Broad Street Veterinary Hospital, except that they employed a steel probe in preference to the wooden probe.

The methods and media used in this survey to culture these stools were very similar to those used by the Communicable Disease Center in Chamblee, Georgia; but a few modifications which were employed by Galton, Hardy, and Mitchell (1950) were introduced.

Immediately after the stools were collected, one to two grams of the feces were introduced into brilliant green tetrathionate broth. Salmonella-Shigella agar, brilliant green agar, and MacConkey's agar were used for cultivation and isolation of the *Salmonella* organisms. All non-lactose fermenting colonies were tested on triple sugar iron agar. Presumed *Salmonella* positives were confirmed by inoculating urea broth.

The cultures giving a negative reaction on the urea were retained; and lactose, sucrose, salicin, aesculin-adonitol-salicin-sucrose, dextrose, and tryptone media were inoculated with the remaining cultures. The remaining suspected cultures were then subjected to more biochemical reactions on maltose, mannitol, xylose, gelatin, and litmus milk. All of the suspected positives were then subjected to serological examination. If any culture did not give an agglutination on either or both polyvalent and grouping "O" sera, it's biochemical properties were checked as well as using *Paracolotn intermedium* serum, which was provided by Galton (1951). If it still gave a typical *Salmonella* reaction, it was sent with the other positives, which had been grouped, to the Communicable Disease Center, Chamblee, Georgia, for identification as to species.

RESULTS

Thirteen cultures, which were isolated from eight dogs, were sent for identification and all were reported as *Salmonella* organisms. These are

listed in Table I. In one case where two species were isolated from the same dog, there was a double infection, including *Salmonella montevideo* and an undescribed species of *Salmonella*.

TABLE I.—SEROLOGICAL IDENTIFICATION OF ISOLATED ORGANISMS

Number	Polyvalent	Group	Organisms
		PET DOGS	
7-S-B	P	B	S. *typhimurium* var. *copenhagen*
7-B-B	P	B	S. *typhimurium* var. *copenhagen*
157-T-B	P	G	S. *worthington*
189-T-B_1	P	C_1	S. *montevideo*
189-T-B_2	P	C_1	S. *montevideo*
189-T-B_3	P	E	*Salmonella* species
191-T-B	P	E_3	S. *senftenberg*
193-T-B_1	P	C_1	S. *montevideo*
193-T-B_2	P	C_1	S. *montevideo*
		STRAY DOGS	
108-T-M	P	G	S. *worthington*
108-S-M	P	G	S. *worthington*
125-S-M	P	B	S. *typhimurium* var. *copenhagen*
214-T-M	P	E_1	S. *anatum*

NEW SPECIES

It will be noted in Table I that isolate 189-T-B_3 is an unidentified type of *Salmonella*. This species was isolated from a 4 year old pet dog on February 29, 1952, and was reported by Dr. Edwards at the Communicable Disease Center as having serological characteristics of a new species of *Salmonella*. This organism was studied by Dr. Edwards; and the proposed name of *Salmonella westhampton*, for the section of Richmond, Virginia, in which it was found, was accepted by him.

The biochemical characteristics of *Salmonella westhampton* are as follows:

No reaction after thirty days on lactose, sucrose, salicin, aesculin, adonitol, inositol, inulin, raffinose, and dextrin.

Acid and gas produced from dextrose, dulcitol, rhamnose, mannitol, xylose, maltose, sorbitol, arabinose, mannose, fructose, galactose, trehalose, and glycerol.

Hydrogen sulfide not produced.

Indol not produced.

Nitrate reduced to nitrite.

Litmus milk changes from slight acidity in 24 hours to alkaline in 48 hours.

Nutrient broth is turbid with sediment in the bottom of tube.

Citrate is utilized.

Potato slant has tan, glistening growth.

Agar colonies are circular, bluish-gray, and transparent.

Agar slant has a smoky-gray, smooth, glistening growth.

The provisional antigenic formula as reported by Dr. Edwards is III, X : g, s . . .

SUMMARY AND CONCLUSION

This survey, based upon 250 pet dogs and 250 stray dogs, indicated that 5 of the 250 pet dogs and 3 of the 250 stray dogs were positive for *Salmonella* organisms. There was a total of eight *Salmonella* infections among the 500 dogs. These results constitute a two per cent infection for the pet dogs, a 1.2 per cent infection for stray dogs, and an overall percentage of 1.6 per cent for all the dogs examined. If these figures are projected into the total number of pet dogs licensed in 1951, there is evidence that 380 dogs of the 19,000 are carriers of *Salmonella* infections. The computed number of stray dogs which are carriers of the infection is 228 among a total of 19,000. The latter number is approximately the number of stray dogs which were picked up during the year 1951 by the City Dog Pound. Thus, out of 38,000 dogs in the City of Richmond, Virginia, there are theoretically 608 asymptomatic dogs which are carriers of *Salmonella*. It must be noted that the number of dogs quoted above is only an approximate number which was given to the author by the license bureau and by the City Dog Pound. The reason for the inaccuracy of the numbers in regard to the pet dogs is that not all of the people in Richmond bothered to have their dogs licensed, even though it is required by City law. The inaccuracy in the number of stray dogs is due to the fact that it is almost impossible for the dog pound to pick up every stray dog in the area of Richmond.

These results cannot easily be compared with other reported results because most of the authors did not state the type of stools used or the condition of the dogs examined. Craige (1948), however, stated that he obtained a one per cent infection in healthy pet dogs in California. These results are not too divergent from those obtained in this survey. Further, Cruickshank and Smith (1949) reported a one per cent infection in healthy stray dogs in London, which is consistent with the data of this survey.

If diarrheic stools had been run concurrently with the normal stools, there probably would have been a higher percentage of infections; however, that was not the purpose of this survey. Findings, herein reported,

indicate that dogs are reservoirs for *Salmonella* organisms which are capable of infecting man.

Since man and dog are usually close companions, it is possible that this may present a real public health problem. Inevitably, the dog, either directly or indirectly, comes into contact with food eaten by human beings; also the dog has the habit of licking people in the face as an expression of affection, and in this manner may communicate infection directly to man. It is evident, therefore, that the potential danger of normal dogs transmitting Salmonellosis as well as other infections associated with man is sufficiently great to include the dog as an animal worthy of public health concern.

ACKNOWLEDGMENT

This paper is a portion of a thesis which was submitted to the Department of Biology of the University of Richmond in partial fulfillment of the requirements for the degree of Master of Arts.

The writer wishes to express his appreciation to Dr. Robert F. Smart and Mr. William A. Dorsey for their guidance in the writing of this paper.

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General Equation for Conics and Pseudoconics

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A simple construction that makes use of a circle has been shown to yield the parabola, hyperbola, and ellipse (1). An extension of this construction results in pseudoconics shown as La Tosca, Cavaradossi, Boccanegra, and Amelia (2). The present paper covers derivation of a general equation applicable to both conics and pseudoconics.

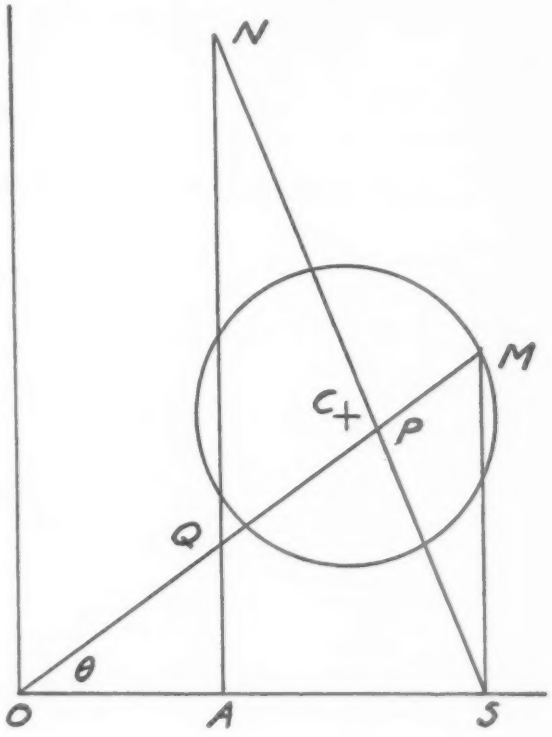

Fig. 1

In Figure 1 consider a system of rectangular coordinates with origin at O. Let C with coordinates (h, k) be the center of a circle of radius a

and let N (f, g) be any point. From M, any point on the circle, draw OM and then draw MS and NA perpendicular to the x-axis. Let NS intersect OM at P and let NA intersect OM at Q. As M moves about on the circle, P describes either a conic or a pseudoconic. Let O also be the center of a system of polar coordinates and let OM make the angle θ with the x-axis. If OM = R, the equation of the circle is

$$R^2 - 2R\,(k \sin\theta + h \cos\theta) + (h^2 + k^2 - a^2) = 0$$

from which

$$R = k \sin\theta + h \cos\theta \pm \sqrt{k^2 \sin^2\theta + hk \sin 2\theta + h^2 \cos^2\theta - h^2 - k^2 + a^2}.$$

Let OP = r

$$OP = OM - PM$$

$$r = R - PM \qquad (1)$$

In the similar triangles NQP and MSP, $\frac{PM}{QP} = \frac{MS}{NQ}$, from which $PM = \frac{(QP)\ (MS)}{NQ}$. Since $QP = OP - OQ = r - \frac{f}{\cos\theta}$, $MS = R \sin\theta$, and $NQ = NA - QA = g - f \tan\theta$, $PM =$

$$\frac{\left(\frac{r\cos\theta - f}{\cos\theta}\right)(R \sin\theta)}{g - f \tan\theta} = \frac{(r\cos\theta - f)(R \tan\theta)}{g - f \tan\theta} =$$

$$\frac{r\ R \sin\theta - f\ R \tan\theta}{g - f \tan\theta} \qquad (2)$$

On substitution of Equation 2 into Equation 1,

$$r = R - \frac{r\ R \sin\theta - f\ R \tan\theta}{g - f \tan\theta} = \frac{g\ R - r\ R \sin\theta}{g - f \tan\theta}$$

$$= \frac{g\ R}{g - f \tan\theta + R \sin\theta},$$ which is the general equation of all curves that result from this construction.

When the center of the circle is at the origin, h = k = f = 0, and g = a. The general equation reduces to $r = \frac{a}{1 + \sin\theta}$, which, on trans-

formation to rectangular coordinates, becomes $x^2 = a^2 - 2\,a\,y$, the equation of a parabola. When $f = a\sqrt{2}$ and $g = -a$, the general equation reduces to $r = \dfrac{a\,R}{a(1 + \sqrt{2}\tan\theta) - R\sin\theta}$, previously shown to be the equation of La Tosca. Similarly, the general equation can be shown to apply to all the other conics and pseudoconics.

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Phosphate Ion Uptake By Human Red Cells

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The general availability of radioactive phosphorus has made it possible to obtain much new information about the exchange of phosphate ions between the plasma and erythrocytes of various species. Kinetic analysis of this exchange has proved more difficult than the corresponding analysis of cation exchange due to certain unique characteristics of phosphate metabolism in erythrocytes. Although a satisfactory kinetic analysis of phosphate ion exchange has not yet been achieved, some of the properties of this exchange have been studied in our laboratory. These studies and our interpretation of them are reviewed briefly in the present report.

When orthophosphate ions labeled with P^{32} are added to whole blood *in vitro* the labeled phosphate leaves the plasma and is taken up by the cells. This is illustrated in Figure 1 in which typical experiments with human, rabbit, and chicken blood at 37° C. have been plotted. Although within a given species the rate of phosphate uptake is proportional to the cell volume, the initial rate of uptake by rabbit and human blood is typically identical in spite of the difference in hematocrits. The uptake of phosphate by the nucleated cells of chicken blood is much slower than the uptake by the mammalian blood cells. In mammalian erythrocytes the energy-producing reactions are mainly glycolytic, whereas in avian erythrocytes oxidative processes ordinarily produce all of the energy. This suggests a possible connection between glycolysis and phosphate uptake, and to pursue this suggestion most of the following information has been obtained using the non-nucleated erythrocytes of human blood.

It was early found (Gourley and Gemmill, 1950) that the absence of the white cells and platelets in human blood did not significantly alter the rate of phosphate uptake. In these studies therefore it was not considered necessary to separate the cellular elements. A further problem was to establish a suitable controlled condition for these experiments. When blood is equilibrated with air as the gas phase the pH rises slightly during the first three hours of incubation and there is a progressive decrease in the total inorganic phosphate (Gourley 1952a). Under these conditions the inorganic phosphate in the cells decreases before any change in the plasma inorganic phosphate can be detected. During this initial period therefore the net movement of phosphate ions is from the plasma into the cells. In addition, the uptake of phosphate has the characteristics of a first-order reaction, as shown by the linear relationship between the percentage of P^{32} remaining in the plasma and time (Gourley and Gemmill, 1950). Except where otherwise noted, experiments were confined to this period of time. No study has yet been made of the movement of phosphate ions out of the cells.

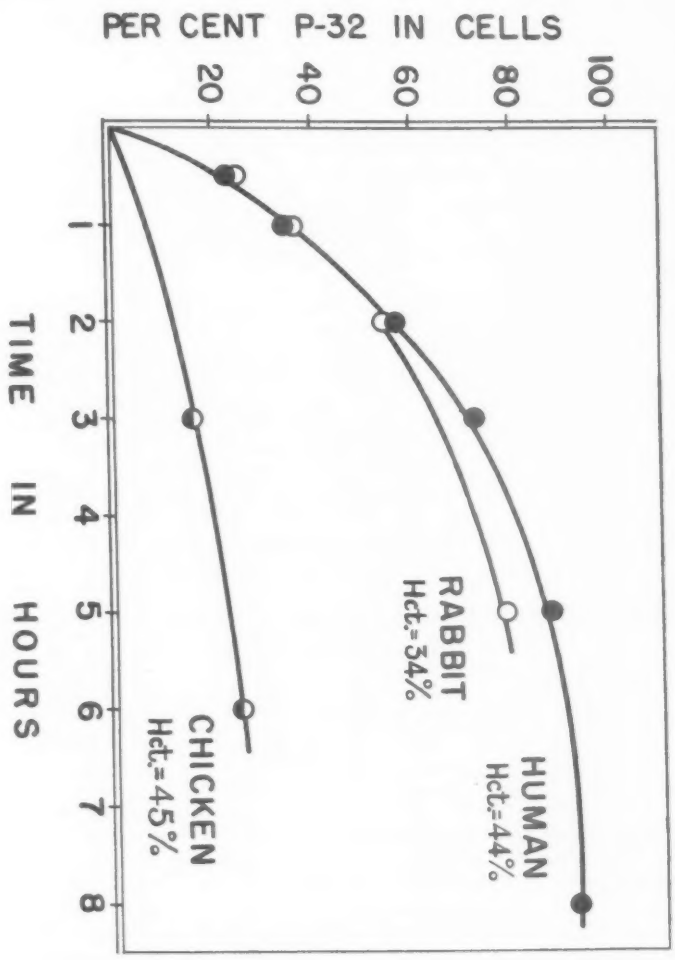

Figure 1. — Uptake of P^{32}-labeled phosphate ions by human, rabbit, and chicken erythrocytes. The hematocrit for the sample of chicken blood was increased from 26% to 45% by discarding some of the plasma prior to the experiment.

As noted above, phosphate uptake by erythrocytes appeared to depend upon the type of metabolism predominant in the cell. Subsequent observations gave further indication that the dominating factor in the uptake of phosphate ions is the cell's supply of energy rather than the physical properties of the cell wall or the phosphate ion itself.

There is a striking effect of temperature on the uptake of phosphate by erythrocytes (Gourley and Gemmill, 1950). There is practically no uptake of phosphate at 15° C. but as the temperature is increased to 40° C. the rate of phosphate uptake also increases. The data fit the Arrhenius equation relating rate and temperature and the activation energy is 16,700 calories. This value is well within the range expected for a chemical reaction and is, in fact, similar to the activation energy of known enzymatic processes.

The effect of phosphate ion concentration on the rate of uptake has recently been investigated in our laboratory by Dr. Jonas. A thousandfold increase in the phosphate concentration does not increase the rate of phosphate ion uptake. This observation and the temperature effect suggest that phosphate ion uptake does not conform to the laws of diffusion. If diffusion does not play a key role in the uptake of these ions by erythrocytes the alternative possibility is a chemical mechanism. Certain observations give indirect support to this possibility.

The human erythrocyte is generally believed to obtain its energy from the metabolism of glucose (Denstedt, 1953). When the glucose concentration in the blood is reduced by incubating the blood for several hours at 37° C., the uptake of phosphate ions by the cells decreases (Table 1).

TABLE 1.—EFFECT OF GLUCOSE ON THE UPTAKE OF P^{32}-LABELED PHOSPHATE IONS BY HUMAN ERYTHROCYTES.

Treatment of blood prior to addition of P^{32}	Blood glucose	% of added P^{32} in cells after 90 minutes
(1) Freshly drawn	90 mg.%	32%
(2) Incubated at 37° C. 9.5 hours	39	21
(3) Incubated at 37° C. 9.5 hours, after which 200 mg.% glucose added	193	32

The addition of glucose returns the phosphate uptake to normal. In addition to its function of supplying the cell with energy, glucose metabolism is therefore apparently necessary for phosphate ion uptake. Assuming that in the human erythrocyte glucose metabolism is mainly glycolytic, it would follow that phosphate uptake, like glycolysis, is independent of the presence of oxygen. This was found indeed to be the case since, in the absence of oxygen, phosphate uptake was essentially the same as it is in the presence of oxygen (Gourley and Gemmill, 1950).

Various steps in the glycolytic pathway can be inhibited more or less specifically by certain chemical substances. Two such substances are iodoacetic acid and sodium fluoride. When glycolysis is completely inhibited with either one of these substances, the rate of phosphate uptake decreases to about one-fifth its normal rate (Gourley, 1951).

All of these features of the uptake of phosphate ions by human erythrocytes implied that chemical reactions rather than physical diffusion alone play a leading role in the process. Beyond the fact that the chemical reactions were glycolytic in nature no information regarding the specific reactions involved had been obtained. In an effort to obtain such information the ultimate fate of the labeled phosphate ions once they enter the erythrocyte was examined (Gourley 1952a). Fortunately most of the labeled phosphate can be recovered in a trichloroacetic acid extract of the cells. Chemical fractionation of this extract revealed that over 70% of the labeled phosphate in the cells was distributed in only six fractions. A time-course study of the ratio of radioactive to stable P (specific activity) in these fractions was made in the hope that the chemical step or steps by which phosphate ions enter the cell might be identified (Figure 2). Based on certain postulates, Zilversmit *et al.* (1943) have derived the conditions necessary in a study of this kind for one substance to be the precursor of another. Briefly, the specific activity of the precursor must be higher than that of the product initially and the two curves must come into equilibrium when the specific activity of the product reaches its maximum.

In the present case the product is cellular inorganic P. It may be seen in Figure 2 that only one of the fractions fulfilled the conditions prerequisite to being a precursor of the cellular inorganic P. This fraction contained the labile phosphate groups of adenosine triphosphate (ATP). Such data do not exclude the possibility that some phosphate ions also diffuse into the cells but strongly indicate that the main pathway is by the formation of ATP at or in the cell membrane.

The effect of iodoacetic acid and sodium fluoride on the various fractions has also been studied (Gourley, 1952b). Both glycolytic inhibitors decrease the concentration of ATP to about 10 per cent of the level in normal blood within three hours. In addition, the turnover of both labile and stable phosphate groups of ATP is significantly reduced by each inhibitor. Thus the same conditions which reduce phosphate ion uptake to one-fifth of the normal rate also decrease the concentration and turnover of ATP. This is additional indication that ATP formation is involved in the uptake of phosphate ions by erythrocytes.

It has already been pointed out that the data presented do not eliminate the possibility that simple diffusion may account for the uptake of some of the phosphate ions. As a matter of fact the uptake of phosphate ions by human blood occurs in at least two phases (Gourley and Matschiner, 1953). There is an initial rapid phase in which less than 20 per cent of the labeled phosphate is removed from the plasma followed by a slow phase which appears to be characteristic of the controlled process

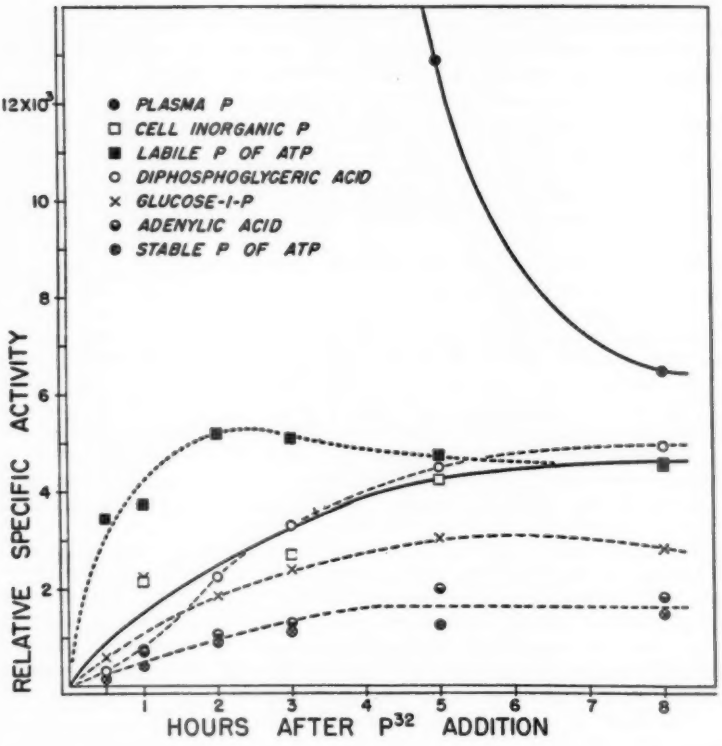

Figure 2. — Time-course of relative specific activity of fractions containing most of the P^{32} entering human erythrocytes. Relative specific activity expressed as counts/min./mg. P calculated to standard addition of 10^5 counts/min./100 ml. blood.

by which the larger proportion of the ions are taken up by the cells. Diffusion may therefore account for the uptake of a small proportion of phosphate ions by erythrocytes.

Attempts to demonstrate an enzymatic mechanism for ATP formation at the surface of the erythrocyte have been unsuccessful to date. It is recognized that direct evidence of this sort is needed to prove the hypothesis advanced in this report.

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ACKNOWLEDGMENT

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Minimum Sums of Squares When the Two Extremes Are Retained

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In using Duncan's Multiple Comparisons Test,[1] one has to find whether the sum of squares of each combination of the ranked means, chosen from $\bar{x}_1$, $\bar{x}_2$, ..., $\bar{x}_n$ and including $\bar{x}_1$ and $\bar{x}_n$, exceeds a calculated significant magnitude. The work is much reduced, if one can find the combination which gives the smallest sum of squares among m varieties, because if this exceeds the calculated number then the rest of the combinations will also.

Rules: 1. Coding the ranked means $\bar{x}_1$, $\bar{x}_2$, ..., $\bar{x}_n$ (in ascending magnitude) by subtracting the mean of all means, $\bar{\bar{x}} = \sum_{i=1}^{n} \bar{x}/n$, from each term, one gets the deviations from the overall mean, y_1, y_2, ..., y_n whose sum is equal to zero.

2. To get the smallest sum of squares among n-1 means, one excludes either y_2 or y_{n-1} whichever has the greater absolute value.

3. To get the smallest sum of squares among n-2 means, one excludes either (a) y_2 and y_3, (b) y_2 and y_{n-1}, or (c) y_{n-2} and y_{n-1}. Between (a) and (b), one excludes the values in (a) if $2y_2 > (n-2+1)(-y_{n-1}-y_3)$ and excludes the values in (b) otherwise. Between (c) and (b) one excludes the values in (c) if $-2y_{n-1} > (n-2+1)(y_2+y_{n-2})$ and excludes the values in (b) otherwise.

4. Similarly, to get the smallest sum of squares among n-k means, one excludes a combination of k means on one or both extremes.

Note: It is advisable to find $S = y_1^2 + y_2^2 + ... + y_n^2$ first. Then the sum of squares among n-1 means excluding y_1 is easily shown to be $S - y_1^2 - y_1^2/(n-1)$ -- (1), and the sum of squares among n-2 ranked means excluding y_1 and y_j is $S - y_1^2 - y_j^2 - (y_1+y_j)^2/(n-2)$ -- (2) and so on.

Rule 2 is obvious from (1). A proof for rule 3 is sketched below.

From (2), it is known that the sum of squares of n-2 means will be a minimum when $M = y_i^2 + y_j^2 + (y_i + y_j)^2/(n\text{-}2)$ is a maximum. Among all pairs of positive y's (y_1 not included) y_2 and y_3 give a maximum M. Among all pairs of negative y's (y_n not included) y_{n-2} and y_{n-1} give a maximum M. If $y_3 > |y_{n-1}|$ then y_2 and y_3 certainly give a maximum M among all pairs. If $|y_{n-1}| > y_2$ then y_{n-1} and y_{n-2} give a maximum M.

Now, one needs to compare y_2, y_3 with y_2 and $y_{k>3}$. One excludes y_2 and y_3 if

$$y_2^2 + y_3^2 + (y_2 + y_3)^2/(n\text{-}2) > y_2^2 + y_k^2 + (y_2 + y_k)^2/(n\text{-}2)$$

or

$$(n\text{-}2)(y_3^2 - y_k^2) > (y_2 + y_k)^2 - (y_2 + y_3)^2$$

$$= (y_k - y_3)(2y_2 + y_3 + y_k)$$

$$(n\text{-}2)(y_3 + y_k) > -(2y_2 + y_3 + y_k) \text{ since } y_3 - y_k \text{ is positive.}$$

Also,

$$2y_2 > (n\text{-}1)(-y_k - y_3).$$

Since the right hand side is maximum when $k = n\text{-}1$, one needs to test y_2, y_3 with y_2 and y_{n-1} and rule 3 is proved.

Similarly, rule 4 may be proved and in fact among combinations of m means, one would exclude the one containing y_i instead of y_{i+j} if $2Y > (m+1)(-y_i - y_{i+j})$ and exclude y_{i+j} instead of y_i, otherwise. Here $Y =$ the sum of all m-1 values of the y's excluded.

Example: From the 9 ranked means 205, 200, 200, 185, 143, 140, 138, 133, and 132 one wants to find the combination of 8 means (including the first and the last means) which gives the minimum sum of squares. Coding by subtracting 164, the mean of 9 means, one obtains 41, 36, 36, 21, -21, -24, -26, -31, and -32 as y_1, y_2, ..., y_9. $\sum_1^9 y^2 = 8392 = S$. Since $y_2 > |y_8|$, the sums of squares among the 8 means excluding y_2, $ss_{13456789}$, gives the minimum sum of squares among any 8 means and $S - y_2^2 - y_2^2/(n\text{-}1) = 6934$.

Among the sums of squares of 7 means one should exclude either y_2, y_3; y_2, y_8 or y_7, y_8. Since y_2 and y_3 are both greater than y_7, y_8, it is obvious that one should exclude y_2, y_3, and the minimum sum of

squares among 7 means is $ss_{1456789} = S - y_2^2 - y_3^2 - (y_2 + y_3)^2/(n\text{-}2) = 5059$.

To get the minimum sum of squares among 6 means one should exclude either (1) y_2, y_3, y_4; (2) y_2, y_3, y_8; (3) y_2, y_7, y_8; or (4) y_6, y_7, y_8. Now, $2(y_2 + y_3) > (6 + 1)(-y_4 - y_8)$. Therefore, if the values in (1) are excluded one gets a smaller sum of squares than if the values in (2) are excluded. Since $2(y_2 + y_8) > (6 + 1)(-y_3 - y_7)$ the values in (2) are excluded instead of the values in (3). Similarly, (4) is preferable over (3). One needs only to compare (1) with (4).

$$y_2^2 + y_3^2 + y_4^2 + (y_2 + y_3 + y_4)^2/(n\text{-}3) = 4475 > y_6^2 + y_7^2 + y_8^2 + (y_6 + y_7 + y_8)^2/(n\text{-}3) = 3307.$$

Therefore, excluding y_2, y_3, y_4 one gets the minimum sum of squares, $as_{156789} = 8392 - 4475 = 3917$.

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News and Notes

(EDITOR'S NOTE: *News contributions should be sent to the person whose name appears at the end of the appropriate section.*)

A MESSAGE TO THE MEMBERS FROM THE PRESIDENT

The time is now propitious for scientists in Virginia to make significant contributions to knowledge. Because of our agricultural background and because of a half-century of impoverishment after the Civil War, it was extremely difficult for Virginia in the past to develop great centers of scientific scholarship. Only those who lived through this period could appreciate the difficulties which had to be overcome.

The situation has now changed and there are many reasons for this change. One of the most important of these is the part played by the Virginia Academy of Science. During the past thirty years the Academy, through such tireless leaders as J. Shelton Horsley, Sr., Wirtley Rudd, and E. C. L. Miller, has done much background work to arouse a genuine interest in science and to create "the will to do" on its behalf.

The background work has been done, however, and the stage is now set for Virginia to win a position of real scientific leadership in the nation. There is only one way by which a region can accomplish this, and that is the hard way of actually making distinguished contributions to scientific knowledge. The discovery of new scientific knowledge must be the spearhead of our scientific activity. The potentialities of the future lie largely in the undiscovered laws of nature all around us.

Most people in Virginia must participate in scientific research. Original scientific investigations should be carried out in our high schools and in our small colleges, at least by the members of the faculty. Dalton, the father of the atomic theory, and Henry the co-discoverer of the laws of electromagnetic induction, were teachers in elementary schools. The discovery of new knowledge is the heart of education. Everyone interested in science can carry out an independent investigation about some phase of nature which interests him. There are enough problems to go around, and it is amazing what a source of pleasure and real accomplishment these modest investigations can be.

Not only should there be a great increase in the number of people who are conducting original investigations in science but the quality of research in our institutions of higher learning and in our industrial laboratories should be greatly improved. We must select problems worthy of our best effort. There must be centers of distinguished scientific scholarship in our entrancing valley of Virginia, in our rolling Piedmont, and in our gracious and historic Tidewater. Such centers must enhance and not deface the great beauty of these regions. Let us not be faint-hearted about this objective to win true scientific leadership in this fast-moving and challenging age in which we now find ourselves.

If this leadership in science can be won, it might help generate a general rejuvenation in the intellectual and cultural leadership in Virginia. There is nothing so infectious as an example of discovery. Let discovery then be the order of the day in Virginia. This will be the keynote of the annual meeting of the Academy at the University of Virginia in May of 1954.

RESEARCH COMMITTEE

Encouragement of research in Virginia has always been one of the chief objectives of the Academy. Research Grants-in-Aid, and also the annually available J. Shelton Horsley Research Award, are offered by the Academy to encourage and stimulate research work of its members. The attention of Academy members is called to the availability of both the Grants-in-Aid, and the Award. The Research Committee urges the greater interest and participation of members in both.

RESEARCH GRANTS-IN-AID

The income from the Academy's Endowment Fund is set aside each year to provide assistance to Academy members who submit to the Research Committee worthy research problems for which financial assistance is needed. Research grants have varied in amount but during recent years have averaged approximately $100.00 each.

Applicants for Research Grants are requested to outline the proposed problem, and list the items for which assistance is required. The names and addresses of three persons who know his qualifications for scientific research should be submitted with the request.

J. SHELTON HORSLEY RESEARCH AWARD

Members of the Academy and officers of Sections are requested to give thought to the entering of papers for the 1954 Horsley Research Award. In recent years the only requirements for eligibility for the J. Shelton Horsley Research Award have been that submitted papers should (1) present original research (2) by Academy members (3) at the annual May meeting, – (4) the paper dealing either with unpublished data or be a published work – if publication had not been prior to May of the previous year. Published papers may be entered as reprints. It is recommended that unpublished manuscripts be suitable in content and length for publication in a recognized scientific journal.

It is anticipated that essentially the same rules will apply to eligibility in 1954. Details of these will be worked out by the Research Committee and will be supplied to every member by the secretaries of the various Sections with their calls for papers for the May meeting. Members desiring details of eligibility before receiving the secretaries' call for papers will be furnished with this information on inquiry to the Research Committee.

The Horsley Award is one of the top prizes available to scientists in Virginia. The widespread interest and participation of members in the seeking of this award will mark a healthy condition with respect to the type of research work being carried out in the state. Such interest and participation is desired and solicited. — W. S. FLORY, *The Blandy Experiment Farm, University of Virginia, Boyce, Virginia.*

COMMITTEE ON LOCAL ARRANGEMENTS

For the Virginia Academy of Science Meeting, May 6-7-8, 1954

F. W. Young ..... General Chairman
Cobb Chemical Laboratory
University, Virginia

Otis L. Updike ..... Housing
Dept. of Engineering
University, Virginia

Edwin E. Floyd ..... Registration and Information

Paul M. Gross ..... Traffic and Parking

Richard H. Henneman ..... Signs and Maps

Edwin W. Pullen ..... Junior Academy Exhibits
Dept. of Anatomy
University Hospital
Charlottesville, Virginia

James W. Cole ..... Commercial Exhibits
Cobb Chemical Laboratory
University, Virginia

Kenneth R. Lawless ..... Meeting Rooms and Equipment

Joseph K. Roberts ..... Geology Field Trip

Horton H. Hobbs ..... Biology Field Trip

Russell J. Rowlett ..... Publicity and News
Research Laboratories
Virginia-Carolina Chemical Corp.
Richmond, Virginia

Mrs. A. T. Gwathmey ..... Entertainment for Ladies

Any inquiries not covered by the above committees should be addressed to F. W. Young, General Chairman.

NOTICE TO SECTION SECRETARIES

Concerning the Virginia Academy of Science Meetings May 6, 7, 8, 1954

The secretaries of the sections must have all material for the program by March 7, in the hands of the Editor-in-Chief, Boyd Harshbarger, Department of Statistics, Virginia Polytechnic Institute, Blacksburg, Va.

SECTION NEWS

AGRICULTURAL SCIENCE SECTION

Dr. Walter S. Flory presented the dedicatory address when the new $425,000 Science Hall at Bridgewater College was dedicated on June 1, 1953. His address was entitled "Basic Science and Applied Science — The Contributions of the Liberal Arts College to These Fields." Two honorary Sc. D. degrees were awarded at Bridgewater College at its June 1 commencement: one to Dr. Robert Burns, Professor of Biology at Johns Hopkins University, and the other to Dr. Walter S. Flory, Professor of Experimental Horticulture, The Blandy Experimental Farm, University of Virginia, Boyce, Virginia.

October visitors at The Blandy Experimental Farm included (1) Len Woefle of Cincinnati and (2) F. G. Meyer of St. Louis. Mr. Woefle is Chairman of the Pancratieae Committee of the American Plant Life Society, and was interested in the rather extensive collection of plants of this tribe — particularly of species of Hymenocallis (the spider lilies) — at the farm. Dr. Meyer, Dendrologist for The Missouri Botanical Garden, went over many of the woody species in The Blandy Farm Arboretum.

R. B. Hall resigned as Assistant Soils Technologist at the Virginia Truck Experiment Station, Norfolk, effective November 15, to accept a position with the American Agricultural Chemical Company.

Dr. Peter L. Henderson has been appointed Associate Professor of Marketing in the Department of Agricultural Economics at Virginia Polytechnic Institute. His work will be in the field of marketing fruits and vegetables. Dr. Henderson is a native of Gordon County, Georgia. He received his Bachelor of Science and Master of Science degrees in Agricultural Economics from the University of Georgia, and his Ph.D. degree in Marketing from Cornell University.

Mr. B. F. Morgan has resigned his position as Extension Milk Marketing Specialist to accept employment as General Manager in the Tri-State Milk Producers Association with headquarters in Bristol, Virginia.

Dr. John T. Buck, Research Poultry Marketing Specialist, Virginia Polytechnic Institute, presented findings of recent research on broiler financing and marketing methods in Virginia before the Virginia Feed Association Convention in Richmond, October 14. Dealing with the factors involved in broiler contracting, his topic was "Is Broiler Financing A Good Deal For Feed Dealers?" Importance of credit to growth of the broiler industry was emphasized and the necessity of wise selection of individual growers to receive credit.

Mr. Maynard C. Conner, Associate Agricultural Economist in Dairy Marketing, presented a paper entitled, "Applying Results of Model Plant Analysis" at the 46th Annual Convention of the Milk Industry Foundation in Boston October 26-28. This discussion was based on a current research project for analyzing dairy plant costs.

Mr. W. W. Lewis, Extension Agronomist at Virginia Polytechnic Institute, is away on leave of absence doing graduate work in Agronomy at the University of Maryland, College Park, Maryland. Mr. Lewis left in September and will be back in February. He is specializing in Plant Breeding and Plant Physiology.

The Department of Agronomy, Virginia Polytechnic Institute, has just received a grant from the Pacific Coast Borax Company to help defray cost of studies in the use of boron on agronomic crops as it affects quality.

A soil survey of Fairfax County, Virginia, was inaugurated on July 1, in response to various county groups, including the firm McHugh and McCrosky who are working out a county plan for the development of Fairfax County. In view of the fact that this survey is to be used largely as a basis for urban development, the county is bearing a portion of the cost. This is the first time in the State of Virginia that a survey has been directed primarily toward a use other than agricultural.

Dr. Walter Leo Griffeth, who completed his Ph.D. degree at Michigan State College, is now Associate Agronomist at the Northern Virginia Pasture Research Station, Middleburg, Virginia. This position was vacated by Dr. Willis Skrdla, who is employed as a turf specialist with the Tactical Air Force at Langley Field, Virginia.

Ralph S. Westing, former Assistant County Agent in Augusta County, has been appointed Assistant Extension Animal Husbandman in charge of swine, to replace George C. Herring, now Assistant Director of Extension.

D. B. Allen, Associate Professor of Animal Husbandry, resigned.

R. C. Carter, Professor of Animal Husbandry with Experiment Station, completed all course work for his Ph.D. at Ames, Iowa, and will return for the winter quarter to complete his dissertation.

W. N. Patterson was appointed Associate Professor of Dairy Husbandry, Virginia Polytechnic Institute, effective August 1, 1953. Professor Patterson obtained his B.S. and M.S. degrees from the University of Wisconsin. At Virginia Polytechnic Institute he will be in charge of the 4-H Dairy Club projects of the Virginia Agricultural Extension Service.

N. R. Thompson returned from leave of absence for graduate study at North Carolina State College and Michigan State College July 1, 1953. He is now Associate Professor of Dairy Husbandry at Virginia Polytechnic Institute, and devotes his full time to dairy research projects.

Professor E. J. Finnegan assumed his duties as Associate Professor of Dairy Husbandry at Virginia Polytechnic Institute September 1, 1953. He

filled the position left vacant by the death of Dr. C. C. Flora. Professor Finnegan will have charge of the Dairy Processing Plant and teach courses dealing with dairy manufacturing. He received his B.S. and M.S. degrees from the University of Massachusetts.

Dr. Flood S. Andrews, Associate Professor in the Department of Horticulture at Virginia Polytechnic Institute, returned from a two-year leave of absence spent in Bolivia on the U. S. Point Four Program. Dr. Andrews will spend approximately two-thirds of his time on research in connection with the production of vegetable crops and one-third in teaching.

Henk Van de Werken has been appointed Instructor in Horticulture at Virginia Polytechnic Institute. Mr. Van de Werken received his horticultural training at the General Horticultural School at Frederiksoord, Holland. His work will be in connection with the research program in floriculture and nursery management.

J. O. Nicholson was advanced from the position of Plant Propagator to the classification of Instructor in the Department of Horticulture at Virginia Polytechnic Institute.

Mr. Lawrence I. Miller, Associate Professor of Plant Pathology, Virginia Agricultural Experiment Station, located at the Tidewater Field Station, Holland, Virginia, was awarded the Ph.D. degree in plant pathology by the University of Minnesota in April, 1953.

WESLEY P. JUDKINS, *Virginia Polytechnic Institute*

SECTION OF ASTRONOMY, MATHEMATICS AND PHYSICS

O. F. Schuette, Jr., Professor of Physics at William and Mary, has received a year's leave of absence to do research in Germany under a Fulbright grant. Professor Gordon L. Vandervort of the University of Wisconsin will be at William and Mary for the year.

Walter M. Miller has joined the Mathematics faculty of Roanoke College. He was formerly on the staff at Washington and Lee.

Professor T. A. Botts, University of Virginia mathematician, has received a grant from the Fund for the Advancement of Education and is spending the year in study and research at the University of Virginia and at the University of Chicago.

Assistant Professor R. W. Royston has returned to the Department of Mathematics of Washington and Lee University after a two-year leave of absence which he spent at the University of Michigan.

Dr. Reuben E. Alley, Jr. has returned to the Physics staff at the University of Richmond as Associate Professor of Physics. For the past two years Dr. Alley has been on the Technical Staff of Bell Laboratories. Mr. A. E. Williamson, formerly at the University of Richmond, has joined the staff of the Southern Research Institute.

Dr. John S. Plaskett has been appointed Acting Assistant Professor of Physics at the University of Virginia. Dr. Plaskett is a native of Great

Britain and was at the Universities of London and Bristol before coming to Rouss Physical Laboratory.

Professor W. L. Archibald of Dalhousie University is spending his sabbatical leave at Rouss Physical Laboratory. Professor Archibald is an authority on the settling of substances in gravitational and centrifugal fields.

Dr. J. W. Sawyer and Mrs. Marion J. Stokes have joined the Department of Mathematics at the University of Richmond as Associate Professor and Instructor respectively.

Dr. J. W. Beams has been appointed the Francis H. Smith Professor of Physics at the University of Virginia.

Dr. Richard Garrett, recent graduate of the University of Virginia, has joined the faculty of Hollins College as Assistant Professor of Physics. He will teach courses in Astronomy as well as in Physics.

Professor Worth J. Young of the Physics staff at Emory and Henry spent the summer in study at Harvard University as the recipient of a Peabody Scholarship.

Members of the Academy will welcome the return of Dr. Fred Allison to Virginia. Dr. Allison recently retired after thirty years service as Head of the Physics Department and Dean of the Graduate School at Alabama Polytechnic Institute. He has accepted an invitation to return to Emory and Henry College as Professor of Physics and Mathematics. Professor Allison began his teaching career at Emory and Henry forty years ago and at that time personally solicited the funds required to construct the Creed Fulton Memorial Building, a combined physics laboratory and observatory.

The Department of Physics of the University of Richmond, in cooperation with the Medical College of Virginia Radiation Laboratory, conducted an indoctrination and training program for Radiological Monitoring Teams this past spring.

Drs. Harold Alden and Alexander Vyssotsky of McCormick Observatory, University of Virginia, were participants in the recent Conference on Astrometric Problems held at Northwestern University.

A group of women's colleges, of which Hollins College is a member, are interested in sponsoring a conference on "The Role of Women in the Physical Sciences." The purpose of the Conference is to explore means of improving the education of women in science and the placing of these women in teaching and research positions. The cooperation of all industries and women's colleges is urgently desired and suggestions will be welcomed.

Professor G. W. Burns, Department of Physics of Mary Washington College, has recently been granted a patent on a combination Household-Clinical Thermometer. It is essentially an ordinary thermometer bent into the form of an L. Professor Burns hopes that it may be used as a clinical thermometer, but can be sold at a much cheaper price than those now used.

Dr. Mary Ann Lee, Chairman of the Department of Mathematics at Sweetbriar College, has been granted a sabbatical leave. She will be at the Naval Air Missile Station. Replacing her is Miss Eleanor Palmer, Instructor in Mathematics.

Randolph-Macon College was host recently at a Scholar's Convocation on the occasion of the formal dedication of Smithey Hall, the new physics and mathematics building. The new building was named for Dr. Royal Bascomb Smithey who retired in 1917 after forty years of service to the College. The convocation was highlighted by speeches by Dr. Gillie A. Larew, Emeritus Dean and Professor of Mathematics at Randolph-Macon Women's College and Dr. John A. Sauer, Chairman of the Department of Physics at Pennsylvania State College.

Friends and colleagues of Kenneth Blair Rhodes, Assistant Professor of Physics at Virginia Military Institute, were saddened by his sudden death in Pittsburgh, Pennsylvania on October 16, 1953. He had been on leave, attending the graduate school of the University of Pittsburgh for three years. At the time of his death he had completed his work for a Ph.D. in physics, and had planned to return to his post at Virginia Military Institute on November 1. He was much loved and respected by both faculty and students, and he will be greatly missed.

IRVING G. FOSTER, *Virginia Military Institute*

BIOLOGY SECTION

George K. Reid, Jr., formerly Assistant Professor of Biology at William and Mary, resigned in June to accept a position in fisheries work at Texas Agricultural and Mechanical College.

Donald H. Bucklin, Ph.D. in Zoology from Washington University and Merck Post-Doctoral Fellow at Harvard University, came to William and Mary in September as Assistant Professor of Biology. His field of research is experimental embryology; most of his work has been with the grasshopper.

Herman Silva Forest, Ph.D. in Botany from Michigan State College, has been appointed Acting Assistant Professor of Biology at William and Mary. His research is on the floristics of freshwater algae.

Bernard Mikula, graduate in 1952 from William and Mary, student of the Virginia flora and now a graduate student at Washington University, spent the past year abroad -- chiefly at the British Museum -- on a special project for the Missouri Botanical Garden and in pursuing his own researches on the systematics of certain groups of Compositae.

Miss Frances E. Silliman, Associate Professor of Biology at Bridgewater College, is on leave of absence during the session of 1953-54, and is studying at the University of North Carolina. Mr. James E. Irvine, IV, of Charlottesville, has been appointed Assistant Professor of Biology for the current session.

A modern, well equipped science hall is the most recent building to be added to the physical plant at Madison College, Harrisonburg, Virginia. The new building will house classrooms, laboratories, and stockrooms for biology, chemistry, geography and geology, and physics departments. The biology department occupies the major portion of the first floor and one-half of the second floor. On the first floor, a plant science laboratory, a general biology laboratory, a large classroom, offices, and storerooms are located. A zoology laboratory, physiology and bacteriology laboratory, a classroom, and office, and storerooms are located on the second floor. Another special feature of the department will be a green house, located at the east end of the science building, which will be used primarily for instructional purposes. A dark room with a light trap entrance will be equipped by Eastman Kodak Company. The new building will be a definite asset to the college as well as to the community.

Mr. Paul R. Burch, formerly Professor of Biology and Head of the Department at Radford College, has announced his retirement after 32 years of teaching. Mr. Burch plans to spend his time in preparing his studies of molluscs in Virginia for publication and in enlarging his extensive collection.

Mr. H. T. Cox of Virginia Polytechnic Institute is on leave of absence to serve as Deputy Executive Director of the American Institute of Biological Sciences. Mr. F. R. Burleson, M.S., Virginia Polytechnic Institute, has been appointed temporary Instructor in Botany in the absence of Mr. Cox.

Mr. G. W. Underhill retired from active service with the Virginia Agricultural Experiment Station after serving the State of Virginia for 35 years. Mr. Underhill has been succeeded by Mr. E. C. Turner, Ph.D., Cornell University, who holds the rank of Associate Entomologist.

Mr. T. B. Davich, Ph.D., University of Wisconsin, has been appointed Associate Entomologist at the Tidewater Field Station of the Virginia Agricultural Experiment Station.

Mr. Vincent Schultz, formerly of the Tennessee Game and Fish Department, has joined the staff of the Virginia Polytechnic Institute Wildlife Unit with half-time assignment to the Virginia Cooperative Wildlife Research Unit.

Mr. David V. Smith, M.S., Duke University, has been appointed Assistant Professor of Forestry at the Virginia Polytechnic Institute.

Mr. Fred S. Orcutt, Professor of Bacteriology at the Virginia Polytechnic Institute, is on leave of absence for this year and is serving as visiting Professor of Biology at the University of Hawaii.

Mr. Kendall W. King, Ph.D., University of Wisconsin, has been appointed Assistant Professor of Bacteriology at the Virginia Polytechnic Institute.

Mr. W. G. Hoag, D. V. M., Cornell University, has been appointed Professor of Animal Pathology at the Virginia Polytechnic Institute.

Mr. Jack D. Burke, Ph.D., University of Florida, and formerly Assistant Professor of Biology at Longwood College, has been appointed to the staff of the Biology Department of the University of Richmond. Mr. Burke is teaching Histology and Embryology and continuing his research on mammalian blood volumes.

Dr. Roy P. Ash, Associate Professor of Biology at the College of William and Mary and long-time member of the Virginia Academy of Science, died on July 21, 1953, in the Medical College of Virginia Hospital, after a long illness.

Roy Phillip Ash was born at Parkersburg, West Virginia, on July 11, 1907. He received the A.B. degree from Marietta College in 1930, and the M.A. and Ph.D. degrees from Brown University, the latter in 1935. In 1935 he was appointed to the College of William and Mary with the rank of Assistant Professor of Biology. In 1949 he was made Associate Professor. From 1942-1946 Dr. Ash served as First Lieutenant and Captain in the Sanitary Corps of the U. S. Army.

Doctor Ash served the Academy faithfully; in 1952 he was a member of the Local Committee on Arrangements, and had been active on other committees. He was a participant in many community affairs. As a teacher he was sound, thorough, and understanding, his courses in Comparative Anatomy and Embryology being especially outstanding.

He is survived by his wife, the former Frances Nenzel and by three sons, Roy Phillip Jr., Charles William, and Andrew Nenzel Ash, all of Williamsburg.

Mr. Robert F. Smart, Chairman of the Biology Department at the University of Richmond, has been granted a sabbatical leave beginning the second semester of this year.

Mr. H. L. Holloway, M.A., University of Richmond, has been appointed Assistant Professor of Biology at Roanoke College. He is completing his work for the Ph.D. degree from the University of Virginia *in absentia*.

ROBERT T. BRUMFIELD, *Longwood College.*

CHEMISTRY SECTION

Bridgewater College has announced the completion of its new $425,000 Science Building, which was dedicated last June with an address by Dr.

Walter S. Flory of the University of Virginia. The three-story structure will house the departments of biology, chemistry, geology, mathematics, physics, and psychology, and has storage facilities in the basement, in addition to space for shops and a museum.

The laboratory facilities for chemistry include two faculty research laboratories and three large undergraduate laboratories, with individual desk space for 230 students. Services to the desks include water, gas, air, 110 volt AC, and variable AC-DC current. Among the new items of equipment are a spectrophotometer, Todd Spectranal, polarimeter, polarizing microscope, chainomatic analytical balances, and nuclear counting equipment.

The science departments at Madison College have also moved into a new building, Burruss Science Hall, part of which is still under construction. Completion of the entire building is not expected for several years.

Of the 1953 graduates, Janet Corbin is teaching chemistry at Waynesboro High School, and Conrad Miller has accepted a research assistantship in chemistry at Oklahoma A. and M. Harold Rhodes, also a chemistry major, has accepted an invitation from the army for temporary duty.

Staff changes at Randolph-Macon Woman's College: Dr. Nan V. Thornton, Head of the Chemistry Department, has been granted a leave of absence to do research at the University of Chicago. Dr. Helen L. Whidden, who received her doctorate last June from the University of Massachusetts, will serve as Acting Head while Miss Thornton is on leave. Dr. Esther B. Leffler, Instructor in Chemistry, has resigned to accept a position in the Chemistry Department of Sweet Briar College, while added to the Randolph-Macon staff have been Miss Helen V. Pashko as Instructor in Chemistry and Miss E. Katherine Wright as Visiting Professor of Chemistry for one year. Miss Pashko received her Master's degree last June from Wesleyan University, Middletown, Conn., and Miss Wright has taught for a number of years at American College, Istanbul, Turkey; last year she served on the staff at Sweet Briar.

From Roanoke College: Judith E. Sund, a chemistry major and a Student Assistant in the Chemistry Department, has been selected to receive a James Lewis Howe Award of the Virginia Blue Ridge Section, A.C.S., for the best "all around" chemistry major at Roanoke College. These awards are made annually by the Blue Ridge Section to an outstanding major in chemistry and chemical engineering in each of the schools of the Section area granting baccalaureate degrees in these fields.

From the University of Richmond: Dr. W. Allan Powell, Assistant Professor of Analytical Chemistry, received his doctorate last June from Duke University. Material from his dissertation was published (with J. H. Saylor) in the June, 1953 issue of *Analytical Chemistry* under the title of "Fluorometric Determination of Small Amounts of Fuoride." Dr. Thomas H. Franklin, with Ray Sothern, presented a paper at the recent American Chemical Society Meeting in Chicago entitled, "The Competitive Adsorption from Aqueous Solutions of Hydrogen and Nitriles on Platinized Platinum." The entire chemistry staff attended the meeting.

Recipients of the M.S. degrees this fall were Ray Sothern and Clayton C. Roth. Mr. Sothern is now doing graduate work in chemistry at Johns Hopkins University and Mr. Roth is now employed with the du Pont Company in Richmond. Mr. Roth is also the first student to receive a Master's degree under the night graduate program. While working full time in local industries he completed the degree requirements within three years.

New graduate students at the University of Richmond this year are Samuel L. Cooke, Phillip L. Oglesby, Emmett H. Poindexter, Jr., all graduates of Richmond, and Charles J. Hansrote, Jr. (Virginia Military Academy), James E. Hardcastle (William and Mary), and Walter J. Triner, Jr. (Moravian College).

Dr. Alfred Burger of the University of Virginia staff was awarded in Paris last summer the Pasteur Silver Medal in recognition of his work in medicinal chemistry. Dr. Burger is also the new chairman of the Division of Medicinal Chemistry of the American Chemical Society.

Dr. Robert E. Lutz has resigned as temporary chairman of the Chemistry Department of the University of Virginia, and the position is being filled by Dr. John H. Yoe, Professor of Chemistry. Dr. Ralph E. Thiers has been granted a leave of absence for the current session and is doing research at the Peter Bent Brigham Hospital of the Harvard Medical School. Dr. John S. Belew has joined the staff as Acting Assistant Professor of Chemistry.

Dr. Robert H. Kean of the Virginia-Carolina Chemical Corporation, Richmond, has been promoted from Assistant Director of Research to Director of Development. Mr. George J. Allen, senior chemical engineer with the Research Department, has been transferred from Charleston, S. C., to Richmond, where he will be in charge of a pilot and process development unit now under construction.

New members added to the Virginia-Carolina research staff since July, 1953, are Matthias F. Kelley, Jr., Brenton S. Halsey, Miss Peggy Jane Harrison, and Mrs. Anne Mays Magnusal. Mr. Kelley joined the department as organic chemist after graduate study at the University of Virginia and has served two years with the navy. Miss Harrison received her Bachelor's degree in chemistry from Mary Washington College last June and is now a research technician with the Fiber Group. Mrs. Magnusal, formerly with the Division of Plant Industry of the State Department of Agriculture, is now a research technician with the Biological Group; she received her Bachelor's degree in biology from Radford College.

Herschel S. Jenkins, Fiber Section Leader at the Virginia-Carolina Chemical Corporation, is writing the section on synthetic protein fibers in the "Encyclopedia of Chemical Technology," Volume 11, to be published by Interscience in the Spring of 1954.

News items from Virginia Military Institute: Dr. C. W. Smart has been promoted to Associate Professor of Chemistry. A. L. Lawrence and R. C. White have been added to the staff as Instructors in Chemistry.

Major George M. Pickral received his doctorate last June from the University of Cincinnati.

Faculty changes at Washington and Lee: Dr. John H. Wise added to the chemistry staff as an Associate Professor and Dr. James K. Shillington as an Assistant Professor. Dr. Wise is a graduate of Haverford College and took his doctorate in physical chemistry at Brown University. He formerly taught at Stanford University. Dr. Shillington is a graduate of Iowa State College and received his Doctor's degree in organic chemistry from Cornell. He comes to Washington and Lee from Amherst College.

Dr. E. S. McKee, who was with the Washington and Lee Department last year, has returned to industry, having accepted a position with the Catalyst Research Company of Baltimore.

Recent additions to the chemistry staff at Virginia Polytechnic Institute are Dr. David W. Levi as Assistant Professor and Mr. Edward C. Kramer, Jr. as Instructor in Chemistry. Dr. Levi is a graduate of Randolph-Macon and received both his Master's and Doctor's degrees from Virginia Polytechnic Institute, his research work being in the field of high polymers under the direction of Dr. P. C. Scherer. Mr. Kramer received his Bachelor's degree from Wagner College, New York, and is pursuing graduate work at Virginia Polytechnic Instiute. During the 1952-53 session he served as research assistant in the department under Dr. F. A. Vingiello.

Mr. W. B. Howsmon, formerly Instructor in Chemistry at Virginia Polytechnic Institute, has returned to Purdue University for work on his doctorate degree.

New graduate teaching assistants at Virginia Polytechnic Institute this year are Peter E. Newallis, B.S. and M.S., Marshall College, West Virginia, and James C. Salonish, B.S., University of Pittsburgh. C. W. Bondurant, Jr., B.S., Emory and Henry College, M.S., Virginia Polytechnic Institute, and C. F. Epes, Jr., B.S., Virginia Polytechnic Institute, are new research assistants working under Dr. P. C. Scherer. George B. Tichelaar, B.S. and M.S., DePaul University, Chicago, and Teh-fu-Yen, M.S., University of West Virginia, are new research assistants working under Dr. Robert C. Krug.

Dr. R. C. Krug has been awarded a research contract by the Air Research and Development Command, Baltimore, relating to the preparation of conjugated alkadienes. Dr. P. C. Scherer's Army Ordnance Research Contract has been enlarged for the current year to include a study of dielectric dispersion in polymer solutions.

The sixth paper of a series on the mechanical properties of high polymers has been published by Philip C. Scherer (with James E. Johnson) in the June-August, 1953, issue of *Modern Textile Magazine*.

Dr. J. W. Watson and Dr. F. B. Clough represented the Virginia Polytechnic Institute Chemistry Department at the A. C. S. meeting held in Chicago in September. Dr. Watson is the Councilor for the Blue Ridge Section of the American Chemical Society.

CARL J. LIKES, *Virginia Institute For Scientific Research*

ENGINEERING SECTION

Professor Nelson F. Murphy of the Department of Chemical Engineering, Virginia Polytechnic Institute, attended the annual meeting of the Electrochemical Society at Wrightsville Beach, North Carolina, September 14-16, 1953. He attended a chemical seminar in Pittsburgh, Pennsylvania on October 9, 1953, where he presented a paper entitled "Modern Aspects of Corrosion Theory".

Professor F. C. Vilbrandt of the Department of Chemical Engineering, has been appointed counsel member representing Virginia Polytechnic Institute on the Oak Ridge Institute of Nuclear Study and is acting on the management committee of the Oak Ridge Institute. He attended a meeting of the management committee on October 2, 1953 at Oak Ridge.

Mr. Tilton E. Shelburne, Director of Research, Virginia Council of Highway Investigation and Research, presented a paper on the "Virginia Highway Research Program" at the Florida Highway Conference sponsored by the University of Florida in Gainesville in November, 1953.

GEOLOGY SECTION

The Department of Geology at the University of Virginia has recently received appropriation to purchase a Weissenberg X-ray camera and a two-circle optical goniometer. The addition of these instruments to the department's X-ray analysis laboratory will greatly expand the use of X-rays in problems related to minerals. In the future the department will be equipped not only to do X-ray analysis on powdered materials, as it has in the past, but also to do more detailed analyses using the single crystal methods. The Weissenberg camera will be useful in the identification of crystals, and it can be used to determine crystal unit cell constants, space groups, and ultimately, the atomic positions. The optical goniometer will serve a dual purpose. It will be used to orient crystals before they are X-rayed by the Weissenberg camera, and it will also be used in detailed studies of the morphology of crystals. In many cases crystals can be identified in a few minutes using only the optical goniometer. Research problems and courses involving these advanced techniques are being planned.

The Geology Department at Virginia Polytechnic Institute has been authorized by the State Board of Education to offer the Ph.D. degree and at present two students are working on their doctorates. The department is also pleased to announce that the Virginia Polytechnic Institute Library has been designated as an official repository for all publications of the U. S. Geological Survey.

Camp Holden, the department's field station at Saltville, Virginia, completed its second year of successful operation under the supervision of Dr. W. E. Moore. Students taking instruction represented four schools from three different states.

Five petrographic and two ore microscopes, recently purchased from the American Optical Co., complete the outfitting of a new petrographic laboratory — one of the finest in the country. Recent acquisitions to the department's geophysical equipment include a Hotchkiss superdip, an Askania torsion balance, a seismic prospecting truck, a Gish-Rooney type geohmeter, and a geoscope resistivity outfit.

Several earth resistivity surveys in southwestern Virginia have been made this past fall by Dr. C. E. Sears, Jr. Other studies underway include geologic mapping of Floyd Co. in the Blue Ridge, by Dr. R. V. Dietrich; a survey of the iron deposits in the Clifton Forge area by Frank Lesure, Virginia Polytechnic Institute, 1951, and National Research Council Fellow now studying at Yale University; and a continuation of research on Virginia stone aggregates — a joint project with the Virginia Polytechnic Institute Applied Mechanics Department.

Two bulletins of geologic interest have been published recently by the Virginia Engineering Experiment Station. One deals with Virginia minerals and rocks and is designed primarily to aid the beginning collector or interested layman. Both publications were prepared by Dr. Dietrich. These bulletins, along with the earlier published Virginia Mineral Resources Map, prepared by Dr. B. N. Cooper and Dr. Dietrich, may be purchased for nominal amounts from the Virginia Engineering Experiment Station, Blacksburg, Virginia. The results of a study of the silica sand resources of western Virginia made by Dr. W. D. Lowry will appear in the near future as a bulletin of the Virginia Engineering Experiment Station.

The first issue of a *Mineral Industries Newsletter* has been published by the Virginia Engineering Experiment Station. The *Newsletter*, which will appear periodically, will contain information about minerals and rocks, discussion of topics of general interest to the industry, and technical articles by guest contributors and members of the Virginia Polytechnic Institute faculty, as well as information about the departments of Ceramic Engineering, Geology, Metallurgical Engineering, and Mining Engineering.

PSYCHOLOGY SECTION

Attending a two-day conference on Psychological Resources in the South, held at the Atlanta Biltmore Hotel in July, were Stanley B. Williams, Chairman of the Psychology Section, and Frank A. Geldard of the University of Virginia. This conference was under the sponsorship of the Southern Regional Education Board. The conference resulted in the formation of a permanent organization of representatives of psychology departments in southern institutions which give graduate training. Mr. Williams was assigned to the membership committee of the new organization; it is hoped that the new committee can assess the educational and professional needs and resources of the region and make plans for improvements.

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The following recent personnel changes are reported from the Lynchburg State Colony. Miss Marianne E. Kornfeld left the employ of the Colony in September as a result of receiving an award from the International Institute of Education for study at the University of Zurich. Miss Virginia E. Schoen, who completed her internship at the Colony in October, left to take a position as Psychologist I at Toledo State Hospital. Two new psychologists are on the staff of the Colony. Mr. Eugene D. Alexander of Canisteo, New York, who has done graduate work at Merrill-Palmer and Wayne University in Detroit, and the University of Connecticut, joined the staff as Associate Psychologist in October. He holds an M.A. degree from the University of Connecticut. Mr. John H. Mendenhall assumed the position of Senior Associate Psychologist on November 2. He has done graduate work at the University of North Carolina and has taken summer courses at the New School for Social Research in New York.

Following up the suggestion of Dr. Gilbert J. Rich, there has been established an informal organization of psychologists from the three cities, Lynchburg, Roanoke, and Lexington. Serving as a steering committee are Dr. Rich, Mrs. William MacConnell and Mr. William M. Hinton. Professor L. L. Thurstone spoke at the organizational meeting in Roanoke in May. Mr. John Buck talked on the H-T-P Test at the October meeting, held in Lynchburg.

Mr. John L. McBride, M.A. from Temple University, has joined the staff at Eastern State Hospital, replacing Mr. Jason Z. Edelstein, who has entered Union Theological Seminary in Cincinnati.

Several changes in the staff in Psychology at the University of Virginia have taken place this semester as a result of a year's leave of absence taken by Mr. Frank W. Finger. Mr. Finger is spending the major portion of the current session at Yale University on a Ford Foundation Fellowship and will participate in seminars on methods in the teaching of Psychology. At least part of the year will be spent in traveling to larger institutions in the East and Midwest observing techniques in teaching Psychology at those institutions. At New Haven, Mr. Finger will also be working on a joint research project with Professor Frank Beach in the field of physiological psychology. The new appointments to the staff at the University of Virginia are those of Mr. John Paul Nafe and Mr. Evan G. Pattishall. Mr. Nafe is Visiting Professor of Psychology at the University of Virginia for the 1953-1954 session. Professor Nafe was formerly Chairman of the Department of Psychology at Washington University, St. Louis, and following his retirement last February taught for one semester at Florida State College. Mr. Pattishall, with the title of Acting Assistant Professor of Psychology, is conducing an undergraduate course in social psychology. He comes to Virginia as a Ph.D. from the University of Michigan and was formerly with the Psychological Sciences Division, Office of Naval Research, Washington.

Of interest to the members of the Psychology Section is the report that National Science Foundation Fellowships are again available to students

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in the field of experimental psychology. In previous years it was necessary for candidates to stand a competitive examination in some scientific field related to psychology, and this year for the first time a specific examination in experimental psychology is being prepared. Notices describing these fellowships are now out. Mr. Frank A. Geldard has been appointed as a member of the Committee of Biological and Medical Sciences of the National Science Foundation, and representative in the field of Psycho-biology on this Committee.

RICHARD H. HENNEMAN, *University of Virginia.*

STATISTICS SECTION

Cooperative Graduate Summer Sessions in Statistics. — Beginning in 1954 North Carolina State College, the University of Florida, Virginia Polytechnic Institute, and the Southern Regional Education Board will jointly sponsor cooperative Graduate Summer Sessions in Statistics.

The first session will be conducted by a distinguished faculty at Virginia Polytechnic Institute in the summer of 1954. Additional summer sessions are tentatively planned for North Carolina State College and the University of Florida in the two following years. Subsequent sessions will be rotated among these or other institutions throughout the South.

The summer sessions are designed to carry out a recommendation of the Southern Regional Education Board's Commission on Statistics, on which the three institutions initiating the program are represented. They will be of particular interest to (1) research and professional workers who want intensive instruction in basic statistical concepts and who wish to learn modern statistical methodology; (2) teachers of elementary statistical courses who want some formal training in modern statistics; (3) prospective candidates for graduate degrees in statistics; (4) graduate students in other fields who desire supporting work in statistics; and (5) professional statisticians who wish to keep informed of advanced specialized theory and methods.

Each of the summer sessions will last six weeks and each course will carry three semester hours of graduate credit, with a maximum of six semester hour credits earned in one summer. The courses are arranged to enable the person to take consecutive work in successive summers. The summer work in statistics may be applied at any one of the cooperating institutions in partial fulfillment of the requirements for a Master's degree. The catalog requirements for the degree must be met at the degree-granting institutions. Each Doctoral candidate should consult with the institution from which he desires to obtain the degree regarding the applicability of the summer courses in statistics.

During the first session Professor Maurice Kendall of the University of London will give a course in Multi-variate Analysis, and Dr. Ralph Comstock of North Carolina State College will give one in Quantitative Genetics.

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The staff of the Virginia Polytechnic Institute's Department of Statistics will offer such courses as Probability and Inference, Analysis of Variance, Statistical Methods, Engineering Statistics, Education Statistics, Rank Order Statistics and the Theory of Sequential Methods.

The department includes R. A. Bradley, D. B. Duncan, M. C. K. Tweedie, P. M. Somerville, and Boyd Harshbarger. In addition, other outstanding statistical scholars will direct special afternoon seminars. The agricultural, science, and engineering divisions of the College will make available advanced courses for students who wish to supplement their work in statistics.

The Virginia Polytechnic Institute is located at Blacksburg in the scenic Allegheny Mountains. The summer climate is delightful.

The fee for the Virginia Polytechnic Institute session is $30.00. Board, room, post office box and laundry for the entire session may be had for $76.40. The session will run from June 9 through July 17, 1954.

Inquiries should be addressed to Boyd Harshbarger, Head, Department of Statistics, Virginia Polytechnic Institute, Blacksburg, Virginia.

William A. Thompson has been appointed Associate Professor of Statistics at the Virginia Polytechnic Institute and will devote his time to research under contract with the Army Quartermaster Corps. Mr. Thompson comes from Chicago and did his undergraduate work in mathematics at the University of Illinois. His graduate work has been done at the University of North Carolina. Research for his dissertation has been conducted on a class of all statistics whose distributions are independent of nuisance parameters, and he is applying this theory to the general incomplete block variance component models to find a class of statistics whose distributions depend only on the ratio of two variances involved.

Dr. Boyd Harshbarger has given an invited talk on the application of statistical methods to analytical problems before the Conference on Analytical Methodology of the Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry of the U. S. Department of Agriculture, in Philadelphia on October 20, 1953.

Dr. David B. Duncan of the Virginia Polytechnic Institute has been invited to address the Regional Conference of the American Society for Quality Control to be held February 5-6, 1954, in Baltimore. The title of his talk will be "Student t and F test." He has also been invited to give an address at the Annual Meeting of the Highway Research Board in Washington on January 12, 1954. The title of this talk will be, "Use of Statistics in the Design and Analysis of Highway Research Projects."

Dr. Ralph A. Bradley of the Virginia Polytechnic Institute has been invited to address the Regional Conference of the American Society of Quality Control to be held February 5-6, 1954, in Baltimore. The title of his talk will be, "Some Comments on the Theory and Application of Rank Order Statistics." He has also been invited to address the American Society of Quality Control in Rochester, N. Y. on February 16, 1954. The title of this talk will be, "Application of Paired Comparisons in Qual-

ity Control." Dr. Bradley has also been reappointed chairman of the program committee for the Eastern Region of I. M. S. for 1954.

The Department of Statistics and Statistical Laboratory of Virginia Polytechnic Institute has been awarded a contract with the Office of Ordnance Research, United States Army, for basic research in statistics. Dr. George L. Edgett has been appointed a visiting professor of statistics at Virginia Polytechnic Institute for the first contract period, January 1-September 1, and will be in charge of this contract. Dr. Edgett will be on leave of absence from Queens University, Kingston, Ontario, where he is a Professor of Mathematics. Besides teaching, Dr. Edgett is the consultant statistician for the other departments of Queens University and has advised them on designing of experiments and the interpretation of results. He has also directed many M.A. theses in Mathematical Statistics and published papers on "Frequency Distributions With Given Statistics Which Are Not All Moments," and "The Irrational Number."

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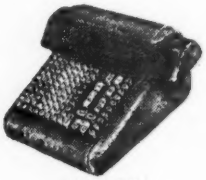

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The contract held by the Department of Statistics and the Statistical Laboratory of the Virginia Polytechnic Institute with the Office of Ordnance Research, U. S. Army has been renewed for another year. Dr. Duncan is chief investigator on this project.

Members of the Statistical Laboratory of the Virginia Polytechnic Institute are acting as consultants on a project for sampling for market practices of livestock auction markets. This project is sponsored by the Southern Regional Livestock Market Research Technical Committee. The statistical laboratory will also analyze the data collected.

Dr. Boyd Harshbarger, Department of Statistics, of the Virginia Polytechnic Institute has been appointed Chairman of the training section of statisticians of the American Statistical Association for the 1954 meeting which will be held at Montreal, Canada, in September.

The Department of Statistics has twenty-five graduates, including men from Canada and South Africa.

WALTER A. HENDRICKS, *Bethesda, Maryland.*